

WATER RESOURCES

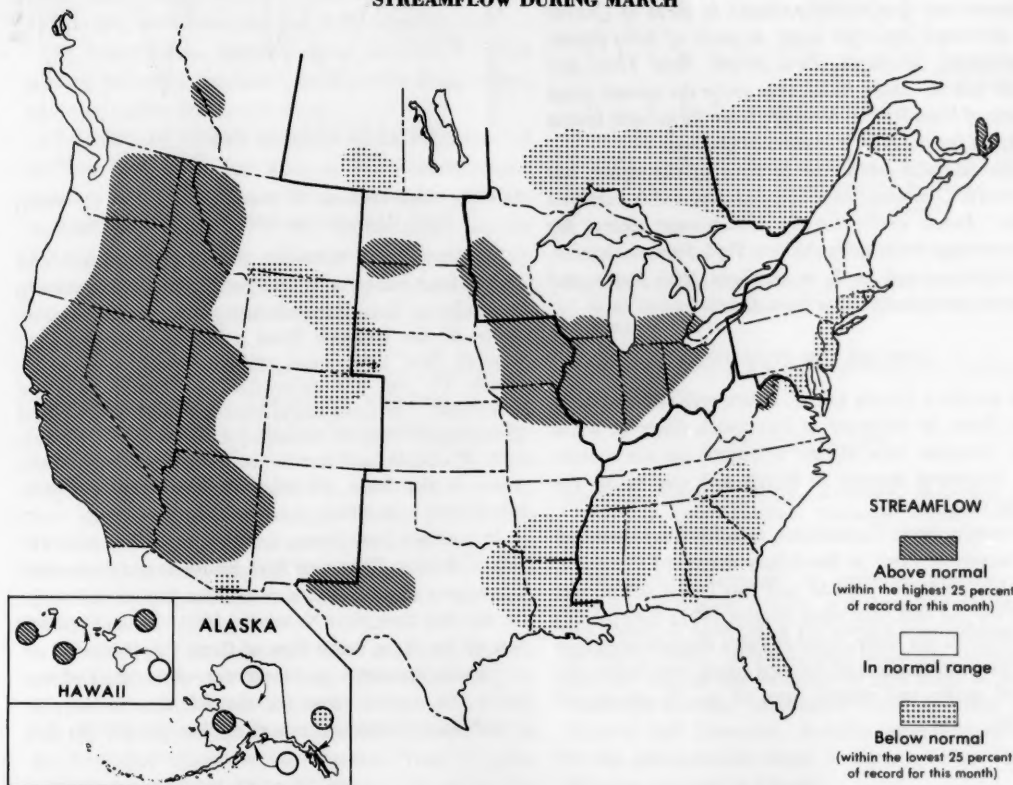
REVIEW for

MARCH 1982

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW DURING MARCH



STREAMFLOW AND GROUND-WATER CONDITIONS

Severe flooding occurred in the Maumee River basin in Indiana and Ohio. Particularly hard hit was Allen County (Fort Wayne) in Indiana where the St. Joseph and St. Marys Rivers combine to form the Maumee River. Flood damages in Allen County alone were estimated at \$20 million and 9,000 residents were forced to evacuate their homes. Peak discharges on many streams in northern Indiana, northwestern Ohio, and southern Michigan were at or close to the highest of record. (More details on pages 5-8.) Flooding also occurred in Illinois and Florida.

Streamflow generally increased in Nevada, Utah, and in northern States of the Northeast and Western Great Lakes Regions, and decreased in Alaska and in most parts of the Southeast Region and south-coastal States in the Northeast Region. Flows were variable elsewhere.

Monthly mean discharges were above the normal range in large areas in and adjacent to Nevada and Illinois. Monthly mean flows were highest of record for March in parts of Indiana and Ohio, and lowest of record in parts of Quebec. Below-normal streamflow persisted in parts of Quebec, Arizona, Florida, Louisiana, Nebraska, and Texas, and decreased into that range in several States in the Southeast Region and south-coastal States in the Northeast Region.

Ground-water levels rose in most of the Northeast Region, but declined in Connecticut and Rhode Island and in northern Maine. Levels were generally near average, except for above-average levels along the New York-Vermont border, and below-average levels in northern New Jersey and adjacent southeastern New York State. In the Southeast Region, levels rose in Virginia and Alabama, and mostly rose or held steady in Georgia. Trends were mixed in other States. Levels were above average in Kentucky, mostly above average in Alabama, below average in Florida, and mixed with respect to average elsewhere. In the Western Great Lakes Region, levels rose or held steady in Minnesota and Indiana, and generally declined in Wisconsin; trends were mixed in Michigan and Ohio. Levels were generally above average in Indiana, above and below average in Minnesota, average in Wisconsin and Ohio, and below average in Michigan. In the Midcontinent Region, water levels rose except for some declines among the wells in Louisiana and Texas. Levels were above average in Iowa and mostly above average in Nebraska; they were below average in Arkansas. In Kansas, Louisiana, and Texas, levels were mixed with respect to average. In the West, water levels rose in Washington, declined or held steady in Arizona, and mostly declined in New Mexico; trends were mixed elsewhere in the region. Levels were above average in Washington and Montana, below average in Arizona, and mostly below average in Idaho, Utah, and New Mexico.

New high ground-water levels for March were reached in Idaho, Montana, and West Virginia. Several alltime high levels were recorded in Indiana. New low levels for March occurred in Arizona, Florida, Idaho, Kansas, Louisiana, Tennessee, and Texas. New alltime low levels were reached in Arizona and Idaho.

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States.]

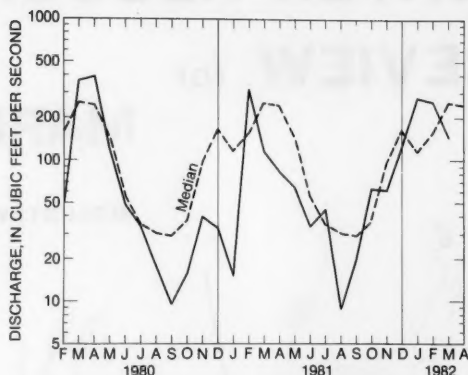
Streamflow generally increased seasonally in Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont, decreased in Connecticut, Maryland, and Rhode Island, and was variable elsewhere in the region. Below-normal streamflow persisted in parts of Quebec and decreased into that range in parts of Nova Scotia, Connecticut, Maryland, New Jersey, New York, and Rhode Island. Mean flows were above the normal range in parts of Nova Scotia. Monthly mean flows were lowest of record for the month in parts of Quebec.

Ground-water levels rose in most of the region, but declined in Connecticut and Rhode Island and in northern Maine. Levels were generally near average, except for above-average levels along the New York-Vermont border, and below-average levels in northern New Jersey and adjacent southeastern New York State.

STREAMFLOW CONDITIONS

In southern Rhode Island, where monthly and daily mean flows in February at Pawcatuck River at Wood River Junction were highest of record for the month, flow decreased sharply in March and was below the normal range.

In southwestern Connecticut, monthly mean discharge of Pomperaug River at Southbury decreased sharply to only 57 percent of median and was below the normal range for the first time since August 1981. (See graph.) Elsewhere in the State, flows at index stations decreased in contrast to the normal seasonal trend, were below the normal range, and ranged from 61 to 76 percent of median.



Monthly mean discharge of Pomperaug River at Southbury, Conn. (Drainage area, 75.0 sq mi; 194.2 sq km)

In New York, snowmelt runoff at midmonth and runoff from heavy rains on March 26 caused increases in streamflow. Some minor flooding was reported in tributaries of the Mohawk River near St. Johnsville. In western New York, most streams were free of ice by March 15 and the snowpack was nearly gone by monthend. On Long Island, monthly mean discharge of Massapequa Creek at Massapequa decreased to 61 percent of median and was below the normal range. Elsewhere in the State, all index stations monitored indicated flows were within the normal range.

In northern New Jersey, monthly mean flow of South Branch Raritan River near High Bridge decreased to only 62 percent of median and was below the normal range for the first time since November 1981. In the southern part of the State, mean flow of Great Egg Harbor River at Folsom decreased to 61 percent of median and was below the normal range for the 5th time in the past 6 months. Cumulative runoff at that site for the first

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6 months of the 1982 water year was 75 percent of median.

In central Maryland, where monthly mean flow of Seneca Creek at Dawsonville was above the normal range in February, flow decreased sharply to only 72 percent of median and was below the normal range for the 4th time in the past 5 months. Flow of the Potomac River near Washington, D.C., increased seasonally, was 122 percent of median, and was in the normal range.

In Pennsylvania, monthly mean flows at all index stations increased seasonally, were greater than median, and were within the normal range.

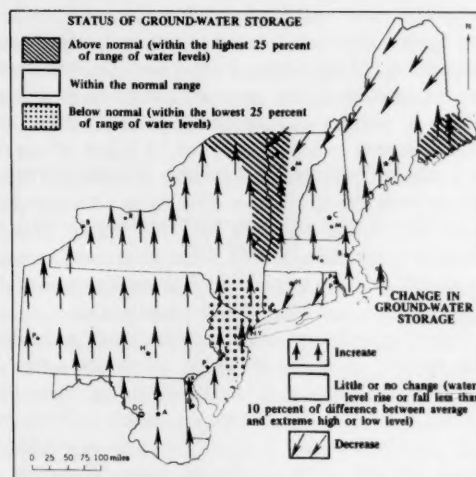
In northern Maine, monthly mean discharge of St. John River below Fish River, at Fort Kent decreased, contrary to the normal seasonal trend, was 81 percent of median, and remained in the normal range for the 4th consecutive month. Elsewhere in Maine and in Massachusetts, New Hampshire, and Vermont, streamflow at index stations increased seasonally and was also within the normal range.

In northern New Brunswick, monthly mean flow of Upsalquitch River at Upsalquitch decreased to only 60 percent of the March median flow and was below the normal range for the first time since January 1981. By contrast, in northern Nova Scotia, mean flow of North-east Margaree River at Margaree Valley increased to 193 percent of median and was above the normal range. Elsewhere in the Atlantic Provinces, monthly mean flows at index stations increased seasonally and were within the normal range.

South of the St. Lawrence River in eastern Quebec, mean flow of Matane River near Matane decreased to 65 percent of median and was below the normal range for the first time since September 1981. North of the St. Lawrence River, monthly mean flows at index stations ranged from 38 to 81 percent of median and were also below the normal range. For example, the monthly mean flow of 1,230 cfs at Outardes River at Outardes Falls (drainage area, 7,300 square miles) was only 38 percent of median and the lowest flow for March in 60 years of record.

GROUND-WATER CONDITIONS

Ground-water levels rose in most of the region. (See map.) Levels generally declined in Connecticut and Rhode Island and in northern parts of Maine, New Hampshire, and Vermont. Levels near end of month were mostly near average. However, levels were above average along bordering parts of New York and Vermont, and also in extreme eastern Maine. Levels were below



Map shows ground-water storage near end of March and change in ground-water storage from end of February to end of March.

average in northern New Jersey and adjacent southeastern New York State.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow increased in parts of Florida, North Carolina, and West Virginia, and decreased elsewhere in the region, in contrast to the normal seasonal pattern of increasing flows. Below-normal streamflow persisted in parts of Florida and returned to that range in parts of Alabama, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee. Monthly mean flows remained in the above-normal range in parts of West Virginia. Flooding occurred in Florida.

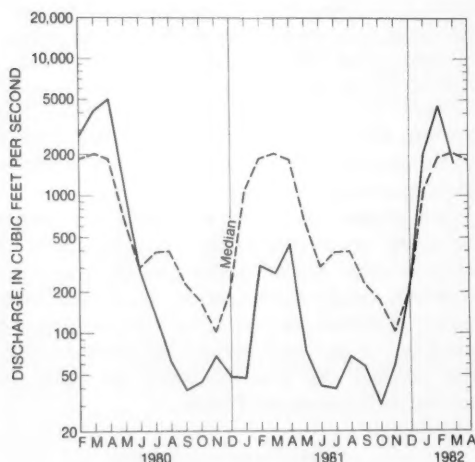
Ground-water levels rose in Virginia and Alabama, and mostly rose or held steady in Georgia. Trends were mixed in other States. Levels were above average in Kentucky, mostly above average in Alabama, below average in Florida, and mixed with respect to average elsewhere. A new high level for March was reached in West Virginia, and new low levels for March were recorded in Tennessee and Florida.

STREAMFLOW CONDITIONS

In southern Florida, discharge into the outlet canals virtually ceased as Lake Okeechobee, the principal reservoir for the area, increased to an elevation of 11.2 feet above sea level but was still 2.7 feet below the

long-term mean and 5.5 feet below the maximum level for March. Lower month-end elevations for March were recorded in 1931 and 1962. Farther north, in Palm Beach, Martin, and St. Lucie counties, runoff from a single storm at month's end resulted in local flooding. Unofficial reports indicate more than 16 inches of rain fell in a 24-hour period in the vicinity of Lantana. Flood waters from the storm were diverted to a Conservation Area and stored for later use. In central Florida, monthly mean discharge of St. Johns River near Christmas increased, contrary to the normal seasonal pattern of decreasing flows, but was only 30 percent of median, and remained in the below-normal range for the 21st consecutive month. In northern Florida, where mean flow of Apalachicola River at Chattahoochee was above the normal range and 153 percent of median in February, flow decreased sharply to only 59 percent of median in March and was below the normal range. Elsewhere in Florida, mean flows at index stations were less than median, within the normal range, and generally increased from last month.

In Georgia, streamflow decreased, contrary to the normal seasonal trend, and was below the normal range at Flint River near Culloden in the central part of the State and at Altamaha River at Doctortown in the southeast. In the southern part of the State, monthly mean flow of Alapaha River at Statenville decreased sharply to 85 percent of median but was within the normal range. (See graph.) Elsewhere in the State, flows were less than median but within the normal range.



Monthly mean discharge of Alapaha River at Statenville, Ga. (Drainage area, 1,400 sq mi; 3,625 sq km)

In central Alabama, monthly mean flow of Cahaba River at Centreville decreased sharply to $\frac{1}{2}$ the median

flow for March and was below the normal range. Cumulative runoff at this site for the first 6 months of the 1982 water year was 75 percent of median and below the normal range. In the western part of the State, mean flow of Tombigbee River at Demopolis lock and dam near Coatopa also decreased and was below the normal range.

In Mississippi, monthly mean flows at index stations decreased, were below the normal range, and were slightly over half the median flows for March, despite rises in streamflow that began about the first of the month and again about March 20.

In north-central Tennessee, mean flow of Harpeth River near Kingston Springs decreased sharply to 74 percent of median and was below the normal range for the first time since April 1981. Similarly, in the west-central part of the State, monthly mean discharge of Buffalo River near Lobelville decreased to 60 percent of the March median flow and was below the normal range for the first month since May 1981. Mean flows also decreased in eastern Tennessee but were within the normal range and slightly below median.

In Kentucky, monthly mean flows at both index stations decreased, and were within the normal range.

In extreme northern West Virginia, monthly mean flow of Potomac River at Paw Paw increased seasonally to $1\frac{1}{2}$ times the median flow for March and remained in the above-normal range for the 2d consecutive month. Elsewhere in the State, mean flows at index stations were above median but within the normal range.

In Virginia, streamflow averaged 115 percent of normal during March, down sharply from the February average of 160 percent. Mean flows were highest with respect to median in the Shenandoah River basin and lowest in the Chowan River basin. Monthly mean flows at all index stations were slightly above median.

In western North Carolina, where mean flow of French Broad River at Asheville was in the above-normal range and 140 percent of median in February, flow decreased to only 71 percent of median in March and was below the normal range. In the western Piedmont, mean discharge of South Yadkin River near Mocksville also decreased and was below the normal range at 70 percent of median. In the eastern Piedmont and Coastal Plain, mean flows at index stations were near or slightly below median. Runoff from moderate rains on March 6-8 caused rises on most streams, but no flooding was reported.

In South Carolina, monthly mean flow of North Fork Edisto River at Orangeburg decreased and was below the normal range at only 69 percent of median. In the eastern part of the State, high carryover flow from February held flows in the normal range at index stations in the Pee Dee River basin.

GROUND-WATER CONDITIONS

Ground-water levels in West Virginia rose in the north-central third of the State and in Wayne County during March and declined elsewhere. Levels were above average in Monongalia, Preston, Gilmer and Wayne Counties and below average elsewhere. The level in the index well at Glenville reached a new high for March in 29 years of record.

In Kentucky, the level in the key well in the Jackson Purchase region declined slightly but continued above average by 1¾ feet. The level in the key well in the Louisville area, Jefferson County, rose slightly and continued nearly 8 feet above average.

In Virginia, the levels in all three index wells in the Piedmont rose 1½ to 2½ feet. The level in the Matoaka Manor well near Petersburg was above average for the first time in nearly a year; levels in the wells in northern and central Virginia continued below average.

In western Tennessee, the level in the key well in the "500-foot" sand aquifer near Memphis held steady, but nevertheless was at a new March low.

In North Carolina, levels rose seasonally in the eastern Piedmont and in the mountains, and were below average. The level in the key well in the western Piedmont declined ¾ foot and was below average, and the level in the key well in the Coastal Plain declined slightly but was about a foot above average.

In Mississippi, ground-water levels generally rose statewide. Levels in artesian wells screened in the Wilcox Group and in the upper Cretaceous aquifer rose about 1 foot, except near pumping where some declines were noted. Seasonal rises continued in the shallow Mississippi River alluvium in the northwest and shallow water-table aquifers statewide. In the south, levels in the Graham Ferry and Miocene aquifers continued to rise slightly. In the Jackson metropolitan area, levels in the Sparta Sand rose about 2 feet at a number of sites while levels in the Cockfield Formation remained about the same.

In Alabama, water levels generally rose and were near or above average.

In Georgia, levels in the Piedmont rose slightly. In the Savannah area on the coast, levels in the principal artesian aquifer near the center of pumping rose 1 to 2 feet. In outlying areas, levels held steady. In Bryan and Liberty Counties, levels also held steady. Levels near the center of pumping in the Brunswick area changed but little. In the outlying areas, levels declined as much as a foot. In the southwest, levels in the principal artesian aquifer held steady or declined as much as 5 feet.

In Florida, water levels in the principal aquifer, the Floridan, rose slightly but were below average. One well near Lake City set a record low for March. Levels in the

sand and gravel aquifer in northwest Florida continued to decline and were lower than average. Levels in wells in the Biscayne aquifer were also below normal but changed little during the month.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow increased seasonally in northern parts of Illinois, Indiana, and Ohio, and in much of Michigan, Minnesota, and Wisconsin. Monthly mean flows were in or above the normal range except for parts of Ontario. Flooding was widespread in the southern part of the region and peak discharges on many streams in northern Indiana, northwestern Ohio, and southern Michigan were at or close to the highest of record.

Ground-water levels rose or held steady in Minnesota and Indiana, and generally declined in Wisconsin; trends were mixed in Michigan and Ohio. Levels were above average generally in Indiana, above and below average in Minnesota, average in Wisconsin and Ohio, and below average in Michigan. Several alltime high levels were recorded in Indiana.

STREAMFLOW CONDITIONS

Severe flooding began in northern Indiana on March 13 when an estimated 3 to 5 inches of water equivalent in the snow cover went directly into runoff. The rapid snowmelt was the result of temperatures that were well above freezing coupled with a ½ to ¾ inch rainfall on a frozen saturated-ground surface. Streams in many areas were at their highest levels on record as flood waters in the Maumee River basin forced 9,000 residents to evacuate their homes in the Fort Wayne area. Damage estimates for Allen County were set at \$20 million as rivers receded the third week of March. The St. Joseph River basin and the Upper Wabash River basin between North Manchester and Ora also experienced record flooding with widespread inundation of agricultural lowlands and flooding in the towns of Goshen and Plymouth. Selected data on stages, discharges, recurrence intervals, and gaging station locations in northern Indiana and parts of adjacent States are given in the accompanying table and map. In the upper Wabash River basin, the monthly mean discharge of 3,131 cfs in Mississinewa River at Marion (drainage area, 682 square miles) was highest for March in 69 years of record.

In northwestern Ohio, rapid runoff from rain and snowmelt during the period March 11–13 combined to cause major flooding and the loss of seven lives. The flood in the Maumee River basin was the highest since

Provisional data; subject to revision

**STAGES AND DISCHARGES FOR THE FLOODS OF MARCH 1982 AT SELECTED SITES
IN INDIANA, MICHIGAN, AND OHIO**

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Dis- charge (cfs)	Date	Stage (feet)	Discharge		Recur- rence interval (years)
									Cfs	Cfs per square mile	
INDIANA											
03324000	WABASH RIVER BASIN Little River near Huntington	263	1943-	Jan. 4, 1950	(a)	5,990	Mar. 14	19.31	5,700	22	65
03328000	Eel River at North Manchester	417	1929-	Dec. 22, 1967	^b 13.55	7,940	14	14.00	8,500	20	100
03328500	Eel River near Logansport	789	1943-	May 18, 1943	13.20	17,000	14	11.74	12,900	16	20
03330500	Tippecanoe River at Oswego	113	1949-	Oct. 17, 1954	8.64	700	18	8.90	728	6.4	100
03331500	Tippecanoe River at Ora	856	1943-	Apr. 5, 1950	14.4	7,800	15	14.97	8,100	9.5	25-50
STREAMS TRIBUTARY TO LAKE MICHIGAN											
04099510	Pigeon Creek near Angola	106	1945-	Apr. 8, 1950	14.95	744	Mar. 23	13.90	790	7.5	>100
04099750	Pigeon River near Scott	361	1968-	Mar. 5, 1976	7.07	1,780	18	7.62	2,200	6.1	>100
04100222	North Branch Elkhart River at Cosperville	142	1971-	Apr. 7, 1978	7.41	682	23	8.12	880	6.2	>100
04100252	Forker Creek near Burr Oak	19.2	1969-	Mar. 23, 1978	5.67	238	17	6.70	330	17	>100
04100500	Elkhart River at Goshen	594	1931-	Apr. 4, 1950	^c 10.15	5,440	14	11.91	6,200	10	>100
04101000	St. Joseph River at Elkhart	3,370	1947-	Apr. 5, 1950	27.82	18,400	21	27.90	18,600	5.5	30
STREAMS TRIBUTARY TO LAKE ERIE											
04178000	St. Joseph River near Newville	610	1946-	Apr. 6, 1950	17.05	9,710	Mar. 17	17.90	9,400	15	50
04179000	St. Joseph River at Cedarville	763	1955-	May 1, 1956	^d 18.07	10,100	17	22.02	14,000	18	>100
0418000	Cedar Creek near Cedarville	270	1946-	Apr. 5, 1950	11.67	4,870	14	13.04	5,800	21	>100
04181500	St. Marys River at Decatur	621	1946-	Feb. 10, 11, 1959	24.22	11,300	14	24.40	11,200	18	25
04182000	St. Marys River near Fort Wayne	762	1930-	Feb. 11, 1959	19.42	13,600	15	19.64	13,000	17	40
04183000	Maumee River at New Haven	1,967	1946-	Mar. 24, 1978	23.58	22,400	18	24.96	26,500	12	>100
ILLINOIS RIVER BASIN											
05515000	Kankakee River near North Liberty	174	1951-	Oct. 10, 1954	(e)	686	Mar. 17	9.01	825	7	>100
05516500	Yellow River at Plymouth	294	1948-	Oct. 12, 13, 1954	17.13	5,390	16	16.37	4,700	16	>100
05517000	Yellow River at Knox	435	1905-06, 1943-	Oct. 15, 16, 1954	13.75	5,660	18	13.18	5,170	12	>100
05517500	Kankakee River at Dunns Bridge	1,352	1948-	Oct. 22, 1954	13.20	5,300	19	13.17	5,700	4.2	>100
05518000	Kankakee River at Shelby	1,779	1922-	Dec. 21, 1927	^f 11.40	7,200	25	.....	6,730	3.8	>100
MICHIGAN											
STREAMS TRIBUTARY TO LAKE MICHIGAN											
04101500	St. Joseph River at Niles	3,666	1930-	Apr. 5, 1950	15.10	20,200	Mar. 18	14.82	19,800	5	>100
STREAMS TRIBUTARY TO LAKE ERIE											
04176500	River Raisin near Monroe	1,042	1937-	May 19, 1945	(g)	12,900	17	11.16	*22,000	21	>100

Provisional data; subject to revision

**STAGES AND DISCHARGES FOR THE FLOODS OF MARCH 1982 AT SELECTED SITES
IN INDIANA, MICHIGAN, AND OHIO—Continued**

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Dis- charge (cfs)	Date	Stage (feet)	Discharge		Recur- rence interval (years)
									Cfs	Cfs per square mile	
OHIO											
STREAMS TRIBUTARY TO LAKE ERIE											
04183500	Maumee River at Antwerp	2,129	1913—	Mar. 27, 1913	....	40,000	Mar. 17	21.6	26,000	12	>100
04185000	Tiffin River at Stryker	410	1913—	Mar. 23, 1913	16.0	7,600	15	18.33	8,630	20	>100
0419.500	Auglaize River near Defiance	2,318	1913—	Mar. 23, 1913	38.8	120,000	14 or 15	27.39	52,300	28	>100
04192500	Maumee River near Defiance	5,545	1913—	Feb. 16, 1950	13.70	87,100	15	15.85	104,000	19	>100
04193500	Maumee River at Waterville	6,330	1913—	Mar. 1913	19.9	180,000	15	16.32	120,000	20	>100

^aMaximum gage height of 18.43 ft. occurred Feb. 11, 1959.
^bMaximum gage height of 14.00 ft. occurred Feb. 27, 1936.
^cMaximum gage height of 10.33 ft. occurred Mar. 5, 1979.
^dMaximum gage height of 18.62 ft. occurred March 24, 1978.
^eMaximum gage height of 9.04 ft. occurred June 27, 1978.

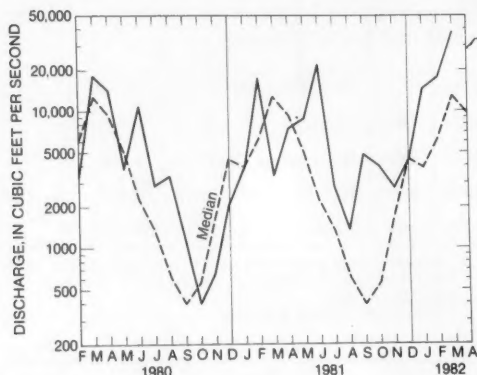
^fMaximum gage height of 11.06 ft. occurred Mar. 5, 1979.
^gMaximum gage height of 10.7 ft. occurred Feb. 1, 1949.
[†]Rough estimate.
^{*}Backwater from ice possible.



Location of stream-gaging stations in Indiana, Michigan, and Ohio, described in table of peak stages and discharges.

(Continued from page 5.)

1913 and exceeded the 1950 flood by approximately 3 feet. The monthly mean discharge of 37,930 cfs and the daily mean flow of 113,000 cfs on the 14th at Maumee River at Waterville were highest for any month in 57 years of record and marked the 3d consecutive month of flow in the above-normal range at that site. (See graph). Six counties in northwestern Ohio were declared disaster areas by Governor Rhodes.



Monthly mean discharge of Maumee River at Waterville, Ohio
(Drainage area, 6,330 sq mi; 16,395 sq km)

In southern Michigan, monthly mean discharge of Red Cedar River at East Lansing increased sharply to 213 percent of median, was over 10 times last month's flow, and was above the normal range as a result of runoff from heavy rains at mid-month. Also in southern Michigan, preliminary peak discharges on the St. Joseph River and River Raisin were at or near the 100-year flood frequency level. About 1,700 people in Monroe County were evacuated at midmonth when the River Raisin rose 2½ feet over flood stage. Estimates of flood damage exceeded \$8 million in Monroe County. Elsewhere in the State, mean flows at index stations were within the normal range. Water content of the snow mantle ranged from 5 to 10 inches in the Upper Peninsula, slightly above normal.

In the Rock River basin in northwestern Illinois, monthly mean flows of Pecatonica River at Freeport and Rock River near Joslin increased seasonally to 185 and 187 percent of their respective median flows and were above the normal range. In the Illinois River basin, monthly mean flow of Sangamon River at Monticello also increased seasonally and remained in the above-normal range for the 2d consecutive month. Severe flooding occurred along the Kankakee River in northeastern Illinois and also along the main stem of the Illinois River. At Peoria, the Illinois River crested early

on March 23 at a stage of 27.1 feet. That was the third highest stage recorded, surpassed only by the 1943 and 1979 floods. The March 1982 flood was estimated to be a 10–15 year frequency event. The Hagar Levee northwest of Beardstown broke March 21, inundating approximately 14,000 acres, although the levees around Beardstown held and no flooding occurred in the town. At Havana, the Zempel Mutual levee was overtopped, inundating 1,000 acres. Considerable property damage, particularly to private homes, occurred along a 20-mile reach of river upstream from Peoria and also at Liverpool.

In Wisconsin, streamflow increased seasonally and was in the normal range as a result of a gradual snowmelt and moderate precipitation that caused an increase in river flows during the latter part of the month. Monthly mean flows at index stations ranged from 72 to 144 percent of median.

In central and east-central Minnesota, monthly mean flows in Crow River at Rockford and Minnesota River near Jordan increased sharply to 327 and 252 percent of their respective median flows. Flow at Rockford remained in the above-normal range for the 2d consecutive month and mean flow at Jordan moved into the above-normal range after being in the normal range for the previous 5 months. In the northwestern part of the State, monthly mean flow of Buffalo River near Dilworth increased seasonally to 320 percent of median and was above the normal range. Elsewhere in the State, streamflow increased seasonally and was generally in the normal range.

In western Ontario, mean flow at English River at Umfreville decreased seasonally to 53 percent of median and was in the below-normal range for the 14th time in the past 15 months. In the eastern part of the Province (north of Lake Huron), mean flow of Missinaibi River at Mattice decreased seasonally, was 59 percent of median, and remained in the below-normal range for the 8th consecutive month. In southeastern Ontario, mean flow of Saugeen River near Port Elgin increased sharply to 90 percent of median and was within the normal range.

GROUND-WATER CONDITIONS

In Minnesota, ground-water levels in shallow water-table wells in the southern part of the State rose in response to recharge from snowmelt; the level in the index well at Hanska rose and was 3½ feet above average. This is the eighth consecutive month that levels have been above average in southern Minnesota. Levels in central Minnesota declined slightly or showed little change. The level in the index well at Camp Ripley held steady but was 1¼ feet below the seasonal average. Water levels

Provisional data: subject to revision

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations in feet above National Geodetic Vertical Datum of 1929 (NGVD), formerly called sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	March 31, 1982	Monthly mean, March		March		
		1982	1981	Average 1900-75	Maximum (year)	Minimum (year)
Superior	599.50	599.57	600.03	599.99	600.97 (1975)	598.32 (1926)
(Marquette, Mich.)						
Michigan and Huron	578.26	578.17	578.74	577.74	579.98 (1973)	575.35 (1964)
(Harbor Beach, Mich.)						
St. Clair	574.60	574.57	574.20	572.68	575.75 (1973)	570.41 (1934)
(St. Clair Shores, Mich.)						
Erie	572.00	571.68	571.27	569.95	572.88 (1973)	567.65 (1934)
(Cleveland, Ohio)						
Ontario	244.73	244.28	244.75	244.34	246.77 (1952)	242.08 (1935)
(Oswego, N.Y.)						

LAKE WINNIPEG AT GIMLI, MANITOBA

Alltime high: 718.26 (July 1974). Alltime low: 709.62 (February 1941).	Monthly mean, March				
	1982	1981	Average 1913-81	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	712.76	712.60	713.06	716.26 (1975)	709.71 (1941)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	March 31, 1982	March 31, 1981	March		
			Average, 1904-81	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	4,199.90	4,200.00	4,198.82	4,204.90 (1924)	4,192.40 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827-1980): 102.1 (1869). Alltime low (1939-1980): 92.17 (1941).	March 30, 1982	March 30, 1981	March		
			Average, 1939-78	Max. daily (year)	Min. daily (year)
Elevation in feet above NGVD:	97.43	97.19	96.02	100.68 (1976)	93.63 (1940)

FLORIDA

Site	March 1982		February 1982	March 1981
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	650	86	590	700
Miami Canal at Miami (southeastern Florida)	0	0	0	88
Tamiami Canal outlets, 40-mile bend to Monroe	1	13	6.80	15.4

(Continued from page 8.)

in surficial aquifers in northern Minnesota continued to decline, but are generally within 1 foot of average.

In Wisconsin, water levels generally declined but continued about average.

In Michigan, levels in the Upper Peninsula declined but rose elsewhere in the State. Levels were below average in most areas.

In northwestern Illinois, the level in the water table well in glacial drift at Princeton, in Bureau County, rose about a foot and continued above average by 3 feet.

Levels rose in much of Indiana in response to heavy precipitation and snowmelt. Several alltime high levels were reached in the northeastern part of the State and near-record highs prevailed in the northwest. Elsewhere in the State, levels were seasonal.

In Ohio, levels rose in the northeast but declined slightly in the central part of the State. Levels were about normal.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow was mixed in the region. It decreased in Arkansas, Louisiana, and Oklahoma, and in parts of Iowa, Kansas, Nebraska, South Dakota, and Texas, and increased seasonally elsewhere. Flows were in the below-normal range in Saskatchewan and in parts of Arkansas, Louisiana, Nebraska, and Texas. Flows remained in the above-normal range in parts of North Dakota, Iowa, Missouri, and Texas.

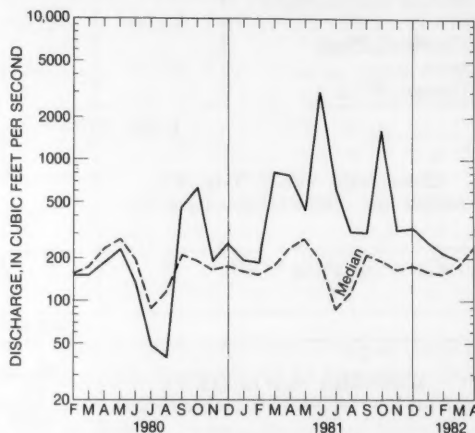
Ground-water levels rose in the region except for some declines among the wells in Louisiana and Texas. Levels were above average in Iowa and mostly above average in Nebraska; they were below average in Arkansas. In Kansas, Louisiana, and Texas, levels were mixed with respect to average, and new low levels for March were recorded.

STREAMFLOW CONDITIONS

In Louisiana, streamflow was below the median and in the below-normal range at all 3 index stations. Monthly mean discharge of Calcasieu River near Oberlin was only 22 percent of median and below the normal range for the 6th time in the past 7 months. The mean flow of Saline Bayou near Lucky was 34 percent of median and in the below-normal range for the 5th consecutive month. Monthly mean flow of Amite River near Denham Springs was 39 percent of median and in the below-normal range—a dramatic reduction from the above-normal

flow of last month. Cumulative runoff for the first 6 months of the 1982 water year was also below the normal range at the 3 index stations.

In Texas, streamflow was above the normal range in the North Concho River Basin (west-central Texas), below the normal range in eastern Texas, and in the normal range elsewhere. The mean discharge of North Concho River near Carlsbad was more than 4 times the March median flow and was in the above-normal range for the 6th consecutive month. By contrast, the mean flow of Neches River near Rockland was only 49 percent of median and remained in the below-normal range. Mean flows at other index stations were above median and in the normal range. For example, monthly mean flow of Guadalupe River near Spring Branch was 112 percent of median. (See graph). Storage increased in 21 reservoirs and decreased in 16 during March.



Monthly mean discharge of Guadalupe River near Spring Branch, Tex. (Drainage area, 1,315 sq mi; 3,406 sq km)

In southern Oklahoma, where monthly mean flow of Washita River near Dickson was above the normal range in February, flow decreased into the normal range and was 134 percent of median. Mean flow at this site for the first half of the water year was 2½ times median and above the normal range. Contents of Lake Texoma increased and was 97 percent of normal capacity, 11 percent above the average for end of March.

In Arkansas, streamflow decreased in contrast to the normal seasonal trend. In southern Arkansas, mean flow of Saline River near Rye was only 47 percent of median and was below the normal range. In northern Arkansas, mean flow of Buffalo River near St. Joe was in the normal range at 68 percent of median.

In Missouri, streamflow was variable. In the northern part of the State, mean flow of Grand River near Gallatin

increased seasonally, was more than $2\frac{1}{2}$ times median, and remained in the above-normal range. In the southern part of the State, where mean flow of Gasconade River at Jerome was also above the normal range last month, flow decreased into the normal range and was 74 percent of median.

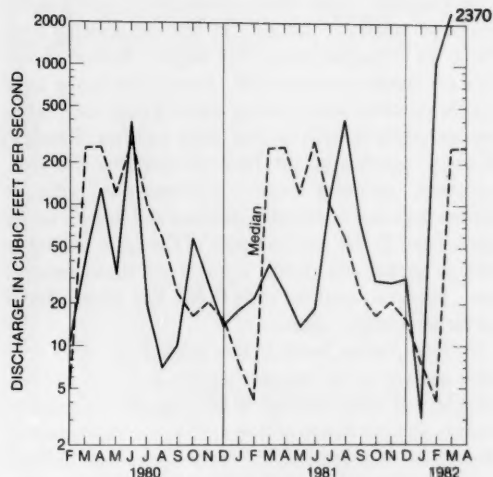
In Kansas, streamflow generally increased seasonally and was in the normal range. Monthly mean flows ranged from 68 to 172 percent of median at index stations. Cumulative runoff for the first half of the 1982 water year was below the normal range in the northwestern part of the State and in the normal range elsewhere. In northwestern Kansas, where flow of Saline River near Russell had been in the below-normal range for 4 of the past 6 months, cumulative runoff was only 37 percent of median.

In northwestern Nebraska, monthly mean discharge of Niobrara River above Box Butte Reservoir increased seasonally, but was only 78 percent of median, and remained in the below-normal range for the 5th consecutive month. Flows elsewhere in the State were in the normal range. Cumulative runoff for the first half of the 1982 water year was also in the normal range except for the Niobrara River station.

In Iowa, streamflow increased and remained above the normal range except for the southwestern part of the State, where mean flow of Nishnabotna River above Hamburg decreased into normal range. As a result of spring runoff, bankfull stages occurred on many streams and some low-land flooding was reported. Mean flow of Des Moines River at Fort Dodge was more than 3 times median and monthly mean flow of the Cedar River at Cedar Rapids was $2\frac{1}{2}$ times median. Cumulative runoff at these 2 sites for the first half of the 1982 water year was about twice the median.

In eastern South Dakota, mean flow of Big Sioux River as measured at Akron, Iowa, increased seasonally and was above median but remained in the normal range. In the western part of the State, where mean flow of Bad River near Fort Pierre was above the normal range last month, flow decreased dramatically to only 15 percent of median and was also in the normal range. Cumulative runoff at both sites for the first half of the 1982 water year was in the normal range.

In southwestern North Dakota, mean flow of Cannonball River at Breien increased, was more than 9 times median, and remained in the above-normal range. (See graph.) Cumulative runoff for the first half of the 1982 water year was also over 9 times the median and was above the normal range. In the eastern part of the State, mean discharge of the Red River of the North at Grand Forks was above median but remained in the normal



Monthly mean discharge of Cannonball River at Breien, N. Dak. (Drainage area, 4,100 sq mi; 10,600 sq km)

range. Cumulative runoff at this site was also above median but within the normal range.

In southeastern Saskatchewan, monthly mean discharges of Qu'Appelle River near Lumsden increased but remained in the below-normal range at 38 percent of median.

GROUND-WATER CONDITIONS

Ground-water levels in southeastern North Dakota rose less than a foot but continued below average. In the southwest, levels rose more than a foot and were slightly above average.

In Nebraska, water levels rose statewide and were slightly above average in most shallow water-table wells.

In Iowa, levels in shallow ground-water wells rose statewide in response to recharge from snowmelt and precipitation. Levels in most key wells were more than 50 percent above average at month's end.

In Kansas, levels rose slightly in four reporting observation wells. However, levels were below average in all except the well in Douglas County. Despite the slight net rise in the well at the Kansas Agricultural Experiment Station, in Thomas County, the level was at a new March low in 35 years of record.

In Arkansas, the level in the key well in the deep Sparta Sand aquifer rose 3 feet but was 24 feet below average. In the industrial aquifer of central and southern Arkansas—also the Sparta Sand—the level in the key well at Pine Bluff rose $4\frac{1}{2}$ feet but was 37 feet below average. The level in the well at El Dorado held steady but was 13 feet below average.

In Louisiana, water levels in the Chicot aquifer in the southwest generally declined in the rice-growing area, where the irrigation season has begun. Several record lows for March were recorded. Levels rose in the Lake Charles industrial area. In the Baton Rouge area, levels rose seasonally in wells in most major aquifers. Levels in all major aquifers of the New Orleans area also rose. Long-term declining trends continued in wells in Miocene aquifers in central Louisiana and in wells in the Sparta Sand in the northern part of the State. Levels in wells in terrace and alluvial aquifers continued seasonal rises. However, levels in wells in the Red River alluvial aquifer were below normal.

In Texas, water levels in key observation wells were above average in the Edwards aquifer at Austin and San Antonio, but below average in the Evangeline aquifer at Houston and the Hueco bolson at El Paso. Levels rose at San Antonio and Houston, but fell at Austin and El Paso. The level in the well at El Paso reached a new low for March in 17 years of record.

WEST

[Alberta, and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow increased in Utah and Nevada, decreased in Alberta, British Columbia, Washington, and Oregon, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Alberta, Arizona, California, Idaho, Montana, Nevada, New Mexico, Utah, and Washington. Below-normal flows persisted in parts of Arizona, Montana, and Wyoming, and decreased into that range in parts of Colorado.

Ground-water levels rose in Washington, declined or held steady in Arizona, and mostly declined in New Mexico; trends were mixed elsewhere in the region. Levels were above average in Washington and Montana, below average in Arizona, and mostly below average in Idaho, Utah, and New Mexico. New high ground-water levels for March occurred in Idaho and Montana, and new lows were recorded in Idaho and Arizona. New alltime lows were reached in Idaho and Arizona.

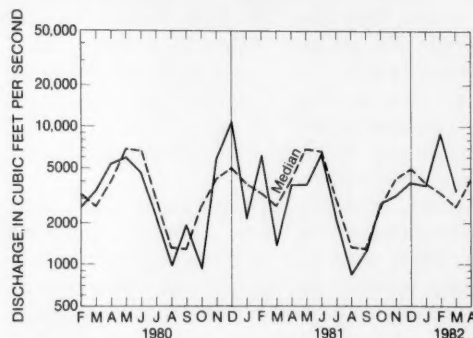
STREAMFLOW CONDITIONS

In western Alberta, mean flow of Bow River at Banff decreased seasonally but remained in the above-normal range for the 2d consecutive month. Cumulative runoff at this site for the first half of the 1982 water year was slightly above median.

In British Columbia, monthly mean discharge at both index stations decreased seasonally and were less than

median but remained in the normal range for the 5th consecutive month. Cumulative runoff for the first 6 months of the 1982 water year was also in the normal range and slightly less than median.

In Washington, streamflow decreased but remained in the above-normal range except for southwestern Washington, where monthly mean flow of Chehalis River near Grand Mound was in the normal range and slightly above median. Mean flow of Spokane River at Spokane, in eastern Washington, was 1½ times median and remained in the above-normal range. On the western slope of the Cascade Mountains in northwestern Washington, where monthly mean flow in February was highest of record at Skykomish River near Gold Bar, flow decreased seasonally to 128 percent of median but remained in the above-normal range. (See graph.)



Monthly mean discharge of Skykomish River near Gold Bar, Wash. (Drainage area, 535 sq mi; 1,386 sq km)

In eastern Oregon, where monthly mean discharge of John Day River at Service Creek was highest for February in 55 years of record, flow decreased to 189 percent of median and remained in the above-normal range. Mean flows at other index stations were in the normal range and slightly above the median flows for March. Cumulative runoff for the first half of the 1982 water year was above the normal range.

In northern Idaho, where monthly mean flow of Clearwater River at Spalding was also highest of record for February, flow decreased slightly to 167 percent of median and remained in the above-normal range. Mean flow of Salmon River at White Bird increased seasonally, was more than 1½ times the median for March, and remained above the normal range. In southeastern Idaho, mean flow of Snake River near Heise also increased seasonally, was 145 percent of median, and remained in the normal range. Cumulative runoff for the first half of the 1982 water year was in the above-normal range in the Salmon River basin.

In western Montana, mean flows of Clark Fork at St. Regis and Middle Fork Flathead River near West Glacier remained in the above-normal range and were about 1½ times median. In southern Montana, monthly mean flow of Yellowstone River at Corwin Springs increased slightly, was 70 percent of median, and was below the normal range for the 8th time in the past 9 months. Flows were in the normal range elsewhere.

In northern Wyoming, monthly mean discharge of Tongue River near Dayton decreased seasonally to 89 percent of median and was below the normal range for the first time in the 1982 water year. In southern Wyoming, mean flow of North Platte River above Seminole Reservoir near Sinclair increased seasonally and remained in the normal range.

In Colorado, streamflow increased seasonally and remained in the normal range except for Bear Creek at Morrison, where mean flow was only 67 percent of median and below the normal range. Monthly mean flows at other stations were slightly above their respective median flows. Cumulative runoff for the first half of 1982 water year in the Animas River at Durango was in the above-normal range.

In Utah, streamflow increased throughout the State and was near or above median. In the southwestern part of the State, mean flow of Beaver River near Beaver was 116 percent of median and remained in the above-normal range. In the northern part of the State, monthly mean flow of Weber River near Oakley remained in the above-normal range at 121 percent of median. Elsewhere in the State, flows were in the normal range.

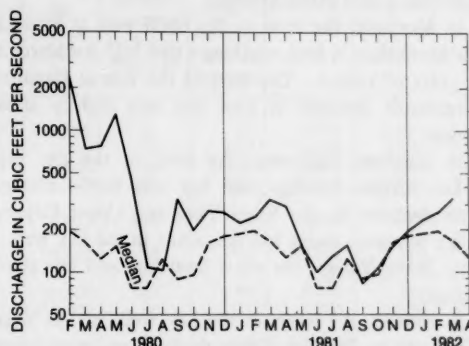
Contents of the Colorado River Storage Project increased 125,000 acre-feet during the month.

In northeastern Nevada, monthly mean discharge of Humboldt River at Palisade increased seasonally, was 192 percent of median, and remained in the above-normal range. Cumulative runoff at this site for the first half of the 1982 water year was also above the normal range.

In north-coastal California, monthly flow of Smith River near Crescent City decreased seasonally but was above the median and in the normal range. Mean flows in other parts of the State were above the normal range. For example, on the Sierra Nevada west slope in northern California, where February flow of North Fork American River at North Fork Dam was the highest for the month in 41 years of record, mean flow decreased to 1½ times median and remained above the normal range. In southern California, mean flow of Arroyo Seco near Pasadena was over 3½ times median and above the normal range for the first time since October 1980.

In Arizona, streamflow increased and remained in the above-normal range except for the southeastern part of

the State. Monthly mean flows were twice the median in Virgin River at Littlefield in northwestern Arizona (see graph), 5½ times median in Little Colorado River



Monthly mean discharge of Virgin River at Littlefield, Ariz. (Drainage area, 5,090 sq mi; 13,180 sq km)

near Cameron in north-central Arizona, more than 12 times median in Verde River below Tangle Creek, above Horseshoe Dam, in west-central Arizona, and almost 3 times median in Salt River near Roosevelt in east-central Arizona. In the southeastern part of the State, mean flow of San Pedro River at Charleston decreased seasonally, was 69 percent of median, and in the below-normal range for the 5th consecutive month. Mean flow in the Gila River at head of Safford Valley, near Solomon, increased seasonally, was almost 3 times median but remained in the normal range.

In southeastern New Mexico, mean flow of Delaware River near Red Bluff decreased seasonally but remained in the above-normal range for the 5th consecutive month. Mean flows at other index stations generally increased, were near or above median, and in the normal range.

GROUND-WATER CONDITIONS

In Washington, the water level in the key well at Spokane, in the eastern part of the State, rose ¾ foot and was 1½ feet above average. In western Washington, the level in the key well at Tacoma rose about a foot and continued above average by nearly 6 feet.

In Idaho, the level in the key well in the sand and gravel aquifer in the Boise Valley declined more than 2 feet but was 2 feet above average and was at a new month-end high level for the second consecutive month. Among the key wells in the Snake River Plain aquifer, levels reached new March lows at Rupert and at Atomic City, despite slight net rises, in 32 and 33 years of record, respectively. At Eden, the level declined nearly a foot, reaching a new alltime low level in 25 years of record.

At Gooding, the level rose slightly but was below average. The level in the well in the alluvium underlying the Rathdrum Prairie rose seasonally nearly 3 feet but was more than 2 feet below average.

In Montana, the level in the Stahl well at Missoula rose more than $\frac{1}{2}$ foot, reaching a new high for March in 22 years of record. The level in the well at Hamilton Fairgrounds declined $\frac{1}{4}$ foot but was slightly above average.

In southern California, the level in the key well in Los Angeles County rose but was below average, levels declined in the Santa Ynez and Upper Cuyama Valley but were above average, while in the key well in Santa Maria Valley, the water level rose and was above average.

In Nevada, the levels in the key wells in Las Vegas Valley and in Paradise Valley declined and were below and above average, respectively. The level in the well in Steptoe Valley rose and was above average.

In Utah, levels generally rose but were below average statewide except in the Blanding area, where the level in the key well declined but continued above average.

In Arizona, the level in the City of Tucson No. 2 well declined slightly and reached a new alltime low in 14 years of record. In the Elfrida well, the level declined and reached a new March low in 31 years of record. There was no net change in the Avra Valley well, but the level was at the alltime low established in February 1982. The level in the Litchfield Park well in the western Salt River Valley declined to a new March low in 17 years of record.

In New Mexico, levels declined and were below average in the Hrna, Dayton, and Hagerman-West key wells. The level in the Berrendo-Smith well declined but was above average, while the level in the Lovington well rose but was below average.

ALASKA

In south-coastal Alaska, where February flows of Little Susitna River near Palmer (drainage area, 61.9 square miles) were highest of record for February, mean flow decreased to 136 percent of median in March but remained in the above-normal range. The daily mean flow of 35 cfs on March 1 was also highest for March in 35 years of record. The mean flow of Kenai River at Cooper Landing was also 136 percent of median but was in the above-normal range. By contrast, mean flow of Gold Creek at Juneau in southeastern Alaska was only 3 percent of median and in the below-normal range. In interior Alaska, mean flow of Chena River at Fairbanks was near the median and in the normal range.

Ground-water levels declined seasonally in the confined aquifer system of Anchorage. The declines ranged from 1 to 5 feet.

HAWAII

Streamflow decreased slightly on the island of Maui but increased seasonally elsewhere. Monthly mean flows were in the above-normal range, except for the island of Hawaii. Monthly mean flows were about $2\frac{1}{2}$ times the median flows for East Branch of North Fork Wailua River near Lihue, Kauai, and for Honopou Stream near Huelo, Maui, and $3\frac{1}{2}$ times median for Kalihi Stream near Honolulu, Oahu. Mean flow of Waiakea Stream near Mountain View, Hawaii was near median and in the normal range.

On Guam, Mariana Islands, where mean flow of Ylig River near Yona was in the above-normal range last month, flow decreased seasonally into the normal range and was 163 percent of median.

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 meter 1 mile = 1.609 kilometers
1 acre = 0.4047 hectare = 4,047 square meters
1 square mile (sq mi) = 259 hectares = 2.59 square kilometers (sq km)
1 acre-foot (ac-ft) = 1,233 cubic meters
1 million cubic feet (mcf) = 28,320 cubic meters

1 cubic foot per second (cfs) = 0.02832 cubic meters per second = 1.699 cubic meters per minute
1 second-foot-day (cfsd) = 2,447 cubic meters
1 million gallons (mg) = 3,785 cubic meters = 3.785 million liters
1 million gallons per day (mgd) = 694.4 gallons per minute (gpm) = 2.629 cubic meters per minute = 3,785 cubic meters per day

FLOW OF LARGE RIVERS DURING MARCH 1982

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1975 (cfs)	March 1982					
				Monthly mean discharge (cfs)	Percent of median monthly discharge, 1951-80	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1-0140	St. John River below Fish River at Fort Kent, Maine	5,690	9,549	1,955	81	-7	2,450	1,580	31
1-3185	Hudson River at Hadley, N.Y.	1,664	2,853	2,210	74	+21	4,200	2,700	31
1-3575	Mohawk River at Cohoes, N.Y.	3,456	5,630	10,400	98	+107	9,000	5,800	31
1-4635	Delaware River at Trenton, N.J.	6,780	11,630	16,573	83	+22	20,700	13,400	30
1-5705	Susquehanna River at Harrisburg, Pa.	24,100	34,200	7,477	104	+16	7,740	5,000	31
1-6465	Potomac River near Washington, D.C.	11,560	¹ 11,190	29,600	122	+4	15,100	9,760	31
2-1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	5,007	10,400	103	+4	2,740	1,770	31
2-1310	Pee Dee River at Peedee, S.C.	8,830	9,657	16,300	90	-21	7,000	4,500	29
2-2260	Altamaha River at Doctortown, Ga.	13,600	13,780	19,480	62	-38	15,000	9,700	29
2-3205	Suwannee River at Branford, Fla.	7,880	6,970	8,000	71	+8	6,640	4,290	31
2-3580	Apalachicola River at Chattahoochee, Fla.	17,200	22,330	24,200	59	-50	17,500	11,300	31
2-4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	22,570	32,580	68	-27	10,800	6,980	30
2-4895	Pearl River near Bogalusa, La.	6,630	9,263	11,690	67	-36	16,000	10,300	31
3-0495	Allegheny River at Natrona, Pa.	11,410	¹ 19,210	44,058	108	+39	59,200	38,300	25
3-0850	Monongahela River at Braddock, Pa.	7,337	¹ 12,360	30,435	143	+25	33,200	21,500	25
3-1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,530	26,450	111	-19	11,300	6,980	30
3-2345	Scioto River at Higby, Ohio	5,131	4,513	12,540	129	-19	58,300	37,700	31
3-2945	Ohio River at Louisville, Ky.	91,170	114,100	258,700	104	+2	265,900	171,900	27
3-3775	Wabash River at Mount Carmel, Ill.	28,635	27,030	107,300	186	+9	87,000	56,000	31
3-4690	French Broad River below Douglas Dam, Tenn.	4,543	¹ 6,794	10,647	91	-29	.....	.....	...
4-0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.	6,150	4,185	3,072	72	+41	3,840	2,480	21
02MC002 (4-2643.31)	St. Lawrence River at Cornwall, Ontario—near Massena, N.Y.	299,000	241,100	254,600	102	+2	262,000	169,000	31
050115	St. Maurice River at Grand Mere, Quebec	16,300	25,300	5,180	62	+29	16,600	10,700	29
5-0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,524	2,200	118	+105	4,900	3,200	31
5-1335	Rainy River at Manitou Rapids, Minn.	19,400	12,950	9,200	95	+14	9,250	5,980	24
5-3300	Minnesota River near Jordan, Minn.	16,200	3,412	8,008	252	+1,228	14,900	9,600	31
5-3310	Mississippi River at St. Paul, Minn.	36,800	¹ 10,580	14,220	184	+167	32,400	20,900	31
5-3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,110	3,696	79	+82	5,700	3,700	27
5-4070	Wisconsin River at Muscoda, Wis.	10,300	8,613	9,284	97	+38	13,200	8,500	24
5-4465	Rock River near Joslin, Ill.	9,551	5,852	17,300	187	+230	15,000	9,700	31
5-4745	Mississippi River at Keokuk, Iowa	119,000	62,570	124,000	147	+147	146,700	94,800	31
6-2145	Yellowstone River at Billings, Mont.	11,796	6,986	2,749	89	-17	2,800	1,800	31
6-9345	Missouri River at Hermann, Mo.	524,200	79,750	112,500	152	-12	90,600	58,600	30
7-2890	Mississippi River at Vicksburg, Miss.	1,140,500	573,600	1,013,500	123	+2	1,128,000	729,000	29
7-3310	Washita River near Dickson, Okla.	7,202	1,414	796	134	-50	560	360	31
8-2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	724	561	98	+22	520	340	31
9-3150	Green River at Green River, Utah	40,600	6,366	4,685	116	+19	3,400	2,200	28
11-4255	Sacramento River at Verona, Calif.	21,257	19,150	55,706	177	+10	33,900	21,900	29
13-2690	Snake River at Weiser, Idaho	69,200	18,170	34,225	173	0	33,430	21,600	29
13-3170	Salmon River at White Bird, Idaho	13,550	11,290	8,074	159	2	8,250	5,330	29
13-3425	Clearwater River at Spalding, Idaho	9,570	15,570	22,620	167	-12	23,170	15,000	29
14-1057	Columbia River at The Dalles, Oreg.	237,000	194,600	315,500	257	+61	.....	.....	...
14-1910	Willamette River at Salem, Oreg.	7,280	23,810	35,600	110	-52	14,650	9,470	31
15-5155	Tanana River at Nenana, Alaska	25,600	23,850	6,194	101	-9	6,000	3,900	30
8MF005	Fraser River at Hope, British Columbia	83,800	96,400	29,300	91	-7	29,500	19,100	31

¹ Adjusted.² Records furnished by Corps of Engineers.³ Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.⁴ Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.⁵ Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1-3185 is 01318500.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF MARCH 1982

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Principal uses: F—Flood control I—Irrigation M—Municipal P—Power R—Recreation W—Industrial	Reservoir	End of Feb. 1982	End of Mar. 1982	End of Mar. 1981	Average for end of Mar.	Normal maximum	Principal uses: F—Flood control I—Irrigation M—Municipal P—Power R—Recreation W—Industrial	Reservoir	End of Feb. 1982	End of Mar. 1982	End of Mar. 1981	Average for end of Mar.	Normal maximum
		Percent of normal maximum							Percent of normal maximum				
NORTHEAST REGION							MIDCONTINENT REGION—Continued						
NOVA SCOTIA							SOUTH DAKOTA—Continued						
	Romignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	82	77	77	64	226,300 (a)		Lake Sharpe (FIP)	102	99	102	100	1,725,000 ac-ft
								Lewis and Clarke Lake (FIP)	79	78	83	84	477,000 ac-ft
QUEBEC							NEBRASKA						
	Allard (P)	38	29	78	32	280,600 ac-ft		Lake McConaughy (IP)	80	82	82	76	1,948,000 ac-ft
	Gouin (P)	47	39	69	47	6,954,000 ac-ft	OKLAHOMA						
MAINE								Eufaula (FPR)	102	107	78	85	2,378,000 ac-ft
	Seven reservoir systems (MP)	52	36	58	35	178,500 mcf		Keystone (FPR)	100	96	86	102	661,000 ac-ft
NEW HAMPSHIRE								Tenkiller Ferry (FPR)	110	104	88	92	628,200 ac-ft
	First Connecticut Lake (P)	20	15	45	16	3,330 mcf		Lake Altus (FIMR)	16	18	21	54	133,000 ac-ft
	Lake Francis (FPR)	23	16	52	21	4,326 mcf		Lake O'The Cherokees (FPR)	98	100	78	87	1,492,000 ac-ft
	Lake Winnepesaukee (PR)	44	62	84	64	7,220 mcf	OKLAHOMA—TEXAS						
VERMONT								Lake Texoma (FMPRW)	94	97	93	88	2,722,000 ac-ft
	Harriman (P)	36	25	39	34	5,060 mcf	TEXAS						
	Somerset (P)	50	45	79	52	2,500 mcf		Bridgeport (IMW)	100	100	32	44	386,400 ac-ft
MASSACHUSETTS								Canyon (FMR)	93	93	95	76	385,600 ac-ft
	Cobble Mountain and Borden Brook (MP)	75	81	86	78	3,394 mcf		International Amistad (FIMPW)	103	102	90	83	3,497,000 ac-ft
NEW YORK								International Falcon (FIMPW)	91	94	91	74	2,668,000 ac-ft
	Great Sacandaga Lake (FPR)	43	29	82	48	34,270 mcf		Livingston (IMW)	101	103	96	84	1,788,000 ac-ft
	Indian Lake (FMP)	52	42	60	48	4,500 mcf		Possum Kingdom (IMPRW)	88	88	88	95	570,200 ac-ft
	New York City reservoir system (MW)	78	85	66	...	547,500 mg		Red Bluff (PI)	19	20	23	30	307,000 ac-ft
NEW JERSEY								Toledo Bend (P)	90	93	83	86	4,472,000 ac-ft
	Wanaque (M)	87	94	62	89	27,730 mg		Twin Buttes (FIM)	50	51	47	31	177,800 ac-ft
PENNSYLVANIA								Lake Kemp (IMW)	59	60	50	85	268,000 ac-ft
	Allegheny (FPR)	24	34	35	35	51,400 mcf		Lake Meredith (FWM)	34	34	17	36	796,900 ac-ft
	Pymatuning (FMR)	83	106	93	93	8,191 mcf		Lake Travis (FIMPRW)	98	96	99	81	1,144,000 ac-ft
	Raystown Lake (FR)	53	68	55	54	33,190 mcf	THE WEST						
	Lake Wallenpaupack (PR)	51	86	65	64	6,875 mcf	WASHINGTON						
MARYLAND								Ross (PR)	40	30	80	29	1,052,000 ac-ft
	Baltimore municipal system (M)	74	76	77	93	83,340 mg		Franklin D. Roosevelt Lake (IP)	91	31	86	50	5,022,000 ac-ft
SOUTHEAST REGION								Lake Chelan (PR)	40	30	59	31	676,100 ac-ft
NORTH CAROLINA								Lake Cushman	92	87	86	84	359,500 ac-ft
	Bridgewater (Lake James) (P)	85	84	85	90	12,580 mcf		Lake Merwin (P)	135	100	101	97	245,600 ac-ft
	Narrows (Badin Lake) (P)	92	94	78	100	5,616 mcf	IDAHO						
	High Rock Lake (P)	66	67	43	83	10,230 mcf		Boise River (4 reservoirs) (FIP)	63	53	87	66	1,235,000 ac-ft
SOUTH CAROLINA								Coeur d'Alene Lake (P)	198	76	76	71	238,500 ac-ft
	Lake Murray (P)	90	87	87	72	70,300 mcf		Pend Oreille Lake (FP)	82	61	60	50	1,561,000 ac-ft
	Lakes Marion and Moultrie (P)	91	85	77	80	81,100 mcf	IDAHO—WYOMING						
SOUTH CAROLINA—GEORGIA								Upper Snake River (8 reservoirs) (MP)	65	68	91	75	4,401,000 ac-ft
	Clark Hill (FP)	85	82	64	74	75,360 mcf	WYOMING						
GEORGIA								Boysen (FIP)	68	61	72	63	802,000 ac-ft
	Burton (PR)	78	84	85	84	104,000 ac-ft		Buffalo Bill (IP)	52	49	78	60	421,300 ac-ft
	Sinclair (MPR)	93	82	90	89	214,000 ac-ft		Keyhole (F)	23	23	53	46	190,400 ac-ft
	Lake Sidney Lanier (FMPR)	50	56	51	60	1,686,000 ac-ft		Pathfinder, Seminole, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	45	46	63	50	3,056,000 ac-ft
ALABAMA							COLORADO						
	Lake Martin (P)	88	85	80	90	1,373,000 ac-ft		John Martin (FIR)	12	14	21	18	364,400 ac-ft
TENNESSEE VALLEY								Taylor Park (IR)	39	34	47	55	106,200 ac-ft
	Clinch Projects: Norris and Melton Hill Lakes (FPR)	50	54	30	52	1,156,000 cfsd		Colorado—Big Thompson project (I)	44	44	70	55	722,600 ac-ft
	Douglas Lake (FPR)	22	37	30	43	703,100 cfsd	COLORADO RIVER STORAGE PROJECT						
	Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parkville Lakes (FPR)	56	63	59	64	510,300 cfsd		Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	62	76	83	...	31,620,000 ac-ft
	Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	53	62	39	56	1,452,000 cfsd	UTAH—IDAHO						
	Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	58	62	40	63	745,200 cfsd		Bear Lake (IPR)	64	67	75	59	1,421,000 ac-ft
WESTERN GREAT LAKES REGION							CALIFORNIA						
WISCONSIN								Folsom (FIP)	65	76	79	61	1,000,000 ac-ft
	Chippewa and Flambeau (PR)	39	26	51	26	15,900 mcf		Hetch Hetchy (MP)	57	52	31	27	360,400 ac-ft
	Wisconsin River (21 reservoirs) (PR)	18	8	42	24	17,400 mcf		Isabella (FIR)	32	36	42	27	568,100 ac-ft
MINNESOTA								Pine Flat (FI)	61	75	77	56	1,001,000 ac-ft
	Mississippi River headwater system (FMR)	18	21	21	19	1,640,000 ac-ft		Clair Engle Lake (Lewiston) (P)	86	86	86	83	2,438,000 ac-ft
MIDCONTINENT REGION								Lake Almanor (P)	93	102	83	53	1,036,000 ac-ft
NORTH DAKOTA								Lake Berryessa (FIMW)	100	101	89	88	1,600,000 ac-ft
	Lake Sakakwea (Garrison) (FIPR)	70	71	70	82	22,700,000 ac-ft		Millerton Lake (FI)	78	97	64	65	503,200 ac-ft
SOUTH DAKOTA								Shasta Lake (FIPR)	83	90	98	84	4,377,000 ac-ft
	Angostura (I)	57	62	74	82	127,600 ac-ft	CALIFORNIA—NEVADA						
	Bell Fourche (I)	43	51	46	62	185,200 ac-ft		Lake Tahoe (IPR)	66	75	48	55	744,600 ac-ft
	Lake Francis Case (FIP)	72	79	77	82	4,834,000 ac-ft	NEVADA						
	Lake Oahe (FIP)	71	77	77	...	22,530,000 ac-ft		Rye Patch (I)	31	50	86	70	194,300 ac-ft
							ARIZONA—NEVADA						
								Lake Mead and Lake Mohave (FIMP)	89	89	89	66	27,970,000 ac-ft
							ARIZONA						
								San Carlos (IP)	23	26	57	22	1,073,000 ac-ft
								Salt and Verde River system (IMPR)	67	83	72	49	2,073,000 ac-ft
							NEW MEXICO						
								Conchas (FIR)	46	46	35	81	330,100 ac-ft
								Elephant Butte and Caballo (FIPR)	36	33	53	29	2,453,000 ac-ft

*Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

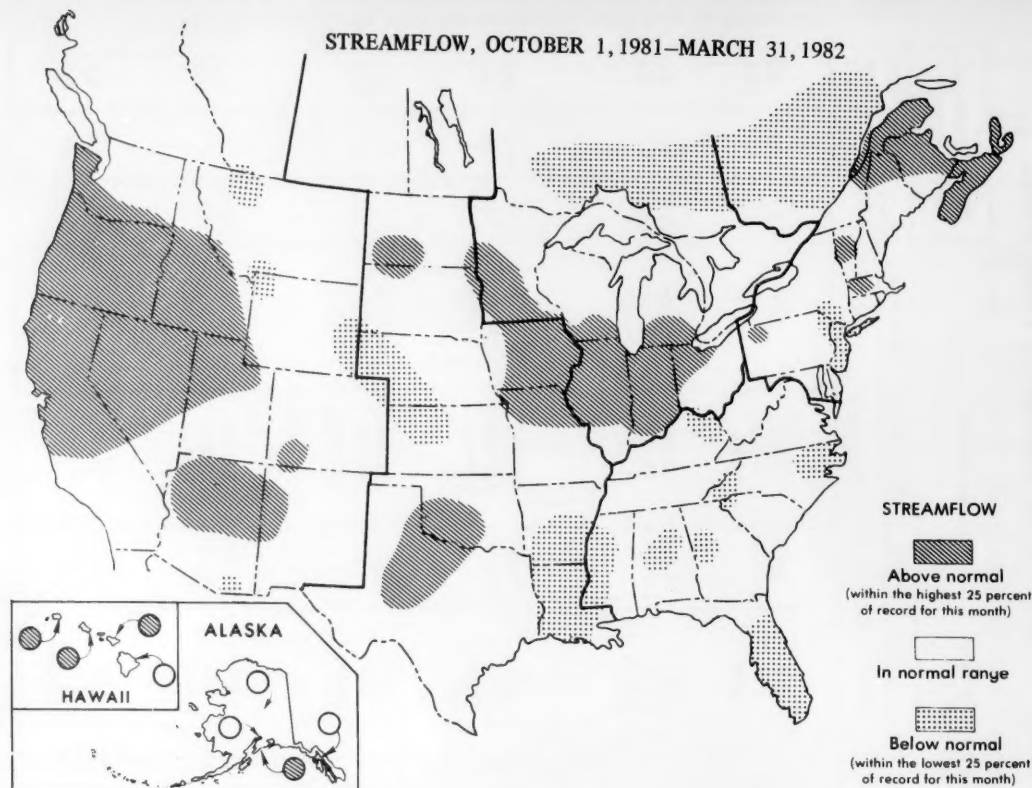
DISSOLVED SOLIDS AND WATER TEMPERATURES FOR MARCH AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	March data of following calendar years	Stream discharge during month Mean (cfs)	Dissolved-solids concentration during month ^a		Dissolved-solids discharge during month ^a			Water temperature during month ^b		
				Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum (tons per day)	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
01463500	NORTHEAST Delaware River at Trenton, N.J. (Morrisville, Pa.)	1982 1945-81 (Extreme yr)	16,660 20,580 c20,040	67 44 (1945)	119 136 (1980)	3,908	1,922 1,100 (1980)	6,618 98,100 (1978)	4.5	2.5 0	6.5 15.0
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y. median streamflow at Ogdensburg, N.Y.	1982 1976-81 (Extreme yr)	255,000 270,400 c250,000	165 164 (1977)	166 170 (1979)	114,000 121,000	112,000 94,000 (1977)	118,000 145,000 (1978)	1.0 1.0	0.5 0	1.0 2.0
07289000	SOUTHEAST Mississippi River at Vicksburg, Miss.	1982 1976-81 (Extreme yr)	1,014,000 843,300 c814,500	187 166 (1979)	235 254 (1980)	534,000 444,000	483,000 180,000 (1981)	603,000 803,000 (1979)	9.0 9.0	6.0 5.0	14.5 14.0
03612500	WESTERN GREAT LAKES REGION Ohio River at lock and dam 53, near Grand Chain, Ill. (25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1982 1955-81 (Extreme yr)	*599,000 556,000 c578,300	158 128 (1955-1964)	230 312 (1968)	..... .....	192,000 54,000 (1968)	474,000 776,000 (1979)	..... .....	3.5 0.5	11.5 14.5
06934500	MIDCONTINENT Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1982 1976-81 (Extreme yr)	112,000 98,016 c74,200	242 186 (1978)	336 530 (1981)	85,300 76,100	54,500 29,300 (1977)	134,000 199,000 (1979)	8.0 7.0	2.0 0	12.5 13.0
14128910	WEST Columbia River at Warrendale, Ore. (streamflow station at The Dalles, Ore.)	1982 1976-81 (Extreme yr)	324,000 162,600 c122,850	93 87 (1980)	116 126 (1979)	88,500 46,600	70,400 25,600 (1980)	105,000 73,300 (1976)	6.0 6.0	5.0 3.0	6.5 8.0

^aDissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.^bTo convert °C to °F: [(1.8 X °C) + 32] = °F.^cMedian of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.

*Dissolved-solids and water-temperatures are for 25 days only (March 1-25).

SUPPLEMENTAL DATA FOR SIX-MONTH PERIOD ENDING MARCH 31, 1982



WATER RESOURCES REVIEW

March 1982

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for March based on 18 index stream-gaging stations in Canada and 164 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for March 1982 is compared with flow for March in the 30-year reference period 1951–80. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for March is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the March flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of March. Water level in each key observation well is compared with average level for the end of March determined from the entire past record for that well or from a 30-year reference period, 1951–80. *Changes in ground-water levels*, unless described otherwise, are from the end of February to the end of March.

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EROSION AND SEDIMENTATION IN THE KENAI RIVER, ALASKA

The abstract and illustrations below are from the report, *Erosion and sedimentation in the Kenai River, Alaska*, by Kevin M. Scott, U.S. Geological Survey Professional Paper 1235, 35 pages, 1982. This report may be purchased for \$3.25 from Eastern Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304 (check or money order payable to U.S. Geological Survey).

ABSTRACT

The Kenai River system is the most important freshwater fishery in Alaska. (See figure 1.) The flow regime is characterized by high summer flow of glacial melt water and periodic flooding caused by sudden releases of glacier-dammed lakes in the headwaters. Throughout most of its 50-mi course across the Kenai Peninsula Lowlands to Cook Inlet, the river meanders within coarse bed material with a median diameter typically in the range 40–60 mm. (See figure 2.) Every nontidal section of the stream is a known or potential salmon-spawning site.

The stream is underfit, a condition attributed to regional glacial recession and hypothesized drainage changes, and locally is entrenched in response to geologically recent changes in base level. The coarseness of the bed material is explained by these characteristics, combined with the reservoirlike effects of two large morainally impounded lakes, Kenai and Skilak Lakes, that formed as lowland glaciers receded. Throughout the central section of the river the channel is effectively armored, a condition that may have important long-term implications for the ability of this section of channel to support the spawning and rearing of salmon.

The 3.8-river-mile channel below Skilak Lake contains submerged, crescentic gravel dunes with lengths of more than 500 ft and heights of more than 15 ft. Such bed forms are highly unusual in streams with coarse bed material. The dunes were entirely stable from 1950 to at least 1977, so much so that small details of shape were unmodified by a major glacial-outburst flood in 1974. The features are the product of a flood greatly in excess of any recorded discharge.

The entrenched section of the channel has been stable since 1950–51 or earlier; only negligible amounts of bank erosion are indicated by sequential aerial photographs. Bank erosion is active both upstream and downstream from the entrenched channel, however, and erosion rates in those reaches are locally

comparable to rates in other streams of similar size. Although erosion rates have been generally constant since 1950–51, evidence suggests a possible recent decrease in bank stability and an increase in erosion that could be related to changes in river use.

The high sustained flow of summer encourages a variety of recreation-related modification to the bank and flood plain—canals, groins, boat ramps, slips, embankments, as well as commercial developments. As population and recreational use increase, development can pose a hazard to the productivity of the stream through increased suspended-sediment concentration resulting directly from construction and, with greater potential for long-term impact, indirectly from bank erosion. A short-term hazard to both stream and developments is the cutoff of meander loops, the risk of which is increased by canals and boat slips cut in the surface layer of cohesive, erosion-resistant sediment on the flood plain within nonentranced meander loops. A significant long-term hazard is an increase in bank erosion rates resulting from the loss of stabilizing vegetation on the high (as high as 70 ft) cutbanks of entrenched and partly entrenched sections of channel. Potential causes of erosion and consequent vegetation loss are river-use practices, meander cutoffs, and groin construction.



Figure 1.—Configuration of the Kenai River downstream from Skilak Lake.

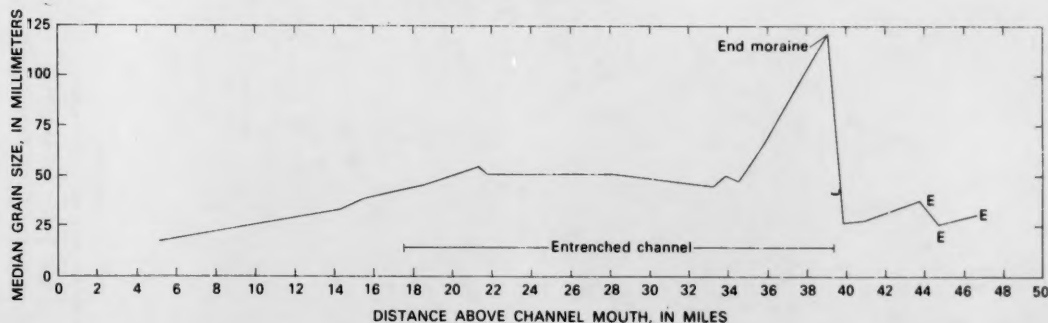


Figure 2.—Bed-material size against river miles. E, estimated.

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